

# PATENT ABSTRACTS OF JAPAN

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## (54) METHOD FOR BREAKING MICROCAPSULE

### (57)Abstract:

PURPOSE: To quickly break microcapsules in a matrix without damaging the surface of the matrix in excellent heat-generation response and uniformity by heating the microcapsules by high-frequency induction heating using a ferromagnetic material.

CONSTITUTION: A ferromagnetic material such as iron or nickel metal, etc., or their alloy is dispersed in a matrix containing microcapsules and the ferromagnetic material is heated by high-frequency induction heating to break the microcapsules in the matrix in high efficiency. The amounts of the ferromagnetic material and the microcapsules compounded to 100 pts.wt. of the matrix are e.g. 1-80 pts.wt. and 1-50 pts.wt., respectively.

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## LEGAL STATUS

[Date of request for examination] 11.11.1999

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CLAIMS

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[Claim(s)]

[Claim 1] The destructive approach of the microcapsule characterized by making a ferromagnetic contain, carrying out induction heating by the RF, and making a microcapsule destroy in the material which made the microcapsule contain.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the approach of destroying efficiently the microcapsule made to contain in a material by induction heating by the RF.

[0002]

[Description of the Prior Art] Like the hardening mold adhesives which encapsulated a part of system of reaction, or a color coupler, the various materials which are made to contain a microcapsule as a control system and attained the control purpose under the destruction are proposed. For example, with the aforementioned hardening mold adhesives, encapsulating and blending a curing agent and raising the storage stability of adhesives, a capsule is destroyed at the time of the need, and a curing agent is opened wide and it is prepared as what could be made to carry out hardening processing (JP,48-76935,A).

[0003] Conventionally, as the destructive approach of the microcapsule in this material, the approach of heating from the exterior with hot blast, an electric furnace, etc. or the approach of destroying by the pressure or mechanical power was learned (JP,3-292378,A).

[0004] However, it was required that the load of heat, the pressure, etc. should have been carried out also to material systems other than a capsule content material, and the load should have been borne by any approach at the whole system, and there was a trouble that the candidate for application was restrained greatly. Incidentally in the case of said adhesives, it is difficult to apply to adherend lacking in pressure resistance by the heating approach from the exterior in large-sized adherends, such as a construction material, and the approach of it being difficult to apply to the adherend of low thermal resistance which is easy to produce heat deformation and melting like plastics, and destroying by a pressure etc.

[0005]

[Problem(s) to be Solved by the Invention] This invention makes a technical problem development of the destructive approach of the microcapsule which can be applied to a broad object without are, carry out, being able to carry out the load of the destructive power alternatively, and there are few direct loads to other material systems, such as adherend, and requiring resistance of the whole system from the material of microcapsule content.

[0006]

[Means for Solving the Problem] This invention offers the destructive approach of the microcapsule characterized by making a ferromagnetic contain, carrying out induction heating by the RF, and making a microcapsule destroy in the material which made the microcapsule contain.

[0007]

[Function] By the above-mentioned configuration which carries out induction heating by the RF, the material containing a ferromagnetic can be heated directly and alternatively, and the microcapsule of content can be destroyed through the generation of heat. Therefore, there are few loads to material systems other than the material containing a ferromagnetic and a microcapsule, and it can apply to broad objects, such as a large-sized object and a low heatproof object, without requiring thermal resistance of

the whole system.

[0008]

[Description of Component Elements of the Invention] This invention makes a ferromagnetic contain with a microcapsule in a material, and destroys a microcapsule by induction heating by the RF. There is especially no limitation about the material which makes a microcapsule and a ferromagnetic contain. As the example, a ceramic system material metallurgy group system material like a material, other paper system materials, etc. for forming a polymer system material, and porosity glass and metallic foil like adhesives or a foam formation material can be raised. In addition, practical use may be presented with this material as mold goods to arbitrary gestalten, such as fiber, and cloth, a sheet.

[0009] Combination of the ferromagnetic to the inside of a material can perform a microcapsule by the method with the proper method blended as what was separated like the method blended as a microcapsule covered with the ferromagnetic like the method which blends the mere mixture of the method and ferromagnetic which are blended with a microcapsule in one, and a microcapsule. In this invention, the ferromagnetic should just contain in the material. In addition, the microcapsule covered with the ferromagnetic can be formed by the method with proper dryblend methods, such as for example, a plating method, powder, and fiber, etc.

[0010] ~~A proper thing may be used for a ferromagnetic.~~ Generally, the alloy which makes a principal component simple substances, such as iron, nickel, chromium, copper, ~~aluminum~~, titanium, zinc, and tin, and it thru/or a constituent, the stainless steel like SUS340, the alloy like a permalloy, the metallic oxide like a ferrite, Fe-nickel-P, the amorphous alloy like Fe-Co, etc. are used. ~~A ferromagnetic can be used with proper gestalten, such as powder, and a staple fiber, a plating object to plastics fine particles.~~

[0011] About the microcapsule which a material is made to contain, it is arbitrary, and is suitably chosen according to the purpose of using a material. Therefore, proper things, such as chemical reaction system matter like a curing agent and physical-change matter like a foaming agent, can be used arbitrarily [ the class of karyomitome included in a capsule ]. From points, such as equal dispersibility, ~~100 micrometers or less, above all, although the particle size of a microcapsule has an about 1-30-micrometer desirable thing, it is not limited to this.~~ In addition, capsulation of karyomitome can be performed by for example, the coacervation method, interfacial polymerization, etc.

[0012] Like ~~polyvinyl alcohol~~, a polyvinyl butyral, polymethylmethacrylate, a polyacrylonitrile, a polyvinylidene chloride, and polysulfone, ~~the wallplate of the microcapsule~~ in this invention may consist of ~~heating melting nature matter~~, and may be destroyed by thermal expansion. In the case of the thermal-expansion nature particle which used the gasification matter especially for karyomitome, it may be formed with arbitrary wallplates.

[0013] The proper method according to physical properties, such as the melting point of a material, the heat-resistant temperature of a microcapsule, etc. can perform preparation of the material containing a ferromagnetic and a microcapsule. The method which mixes a material, a ferromagnetic, a microcapsule, or the microcapsule covered with the ferromagnetic is held using the method and 2 mills which mix the solution of a material, a ferromagnetic, a microcapsule, or the microcapsule covered with the ferromagnetic as the example, 3 mills, a paint roll, a roll mill, an extruder, a Banbury mixer, a planetary mixer, and the proper kneading machine like a kneader. In addition, in the case of the mixed method by heating melting, the microcapsule destroyed at an elevated temperature rather than the melting point of a material is used.

[0014] The ferromagnetic to the inside of a material and the loadings of a microcapsule are suitably determined according to the purpose of using the heating conditions by the destructive property and RF of a microcapsule, and a material etc. Generally, the ferromagnetic of per [ 1 ] material 100 weight section - 80 weight sections and the microcapsule of 1 - 50 weight section are used.

[0015] ~~Destruction of the microcapsule in a material can be performed by heating it through a ferromagnetic in a RF magnetic field.~~ Therefore, when materials are adhesives, by arranging adhesives for example, between adherends and placing it into a RF magnetic field, adhesion processing can be carried out and application on a large area object is also easy. There is especially no limitation about the high-frequency oscillator to be used, and, generally the thing of 104-106kHz, an output 1 - 200kw extent

is used. In addition, the foil of a ferromagnetic etc. may be made to be placed between processing-object systems if needed in this invention for the purpose of improvement in the exoergic effectiveness by the RF, compaction of the processing time, etc.

[0016] The destructive approach of this invention can fabricate the material containing a ferromagnetic and a microcapsule in arbitrary gestalten, and can apply it to various materials thru/or goods.

Incidentally in the case of an adhesives system material, it can use for adhesion of the adhesion of adherend which consists of plastics, wood, and non-magnetic material like gypsum fibrosum, a very inconvenient thing, etc. with [ of a front face ] a blemish preferably especially, for example like structural interior material, such as head lining and a panel for wall surfaces.

[0017]

[Example]

Dissolve the example 1 chloroprene-rubber 100 section (it is the same the weight section and the following), the denaturation rosin resin 20 section, and the terpene phenol resin 15 section in toluene, and the adhesives solution of 30 % of the weight of solid content concentration is prepared. the microcapsule (the Matsumoto fats-and-oils company make --) of the thermal-expansion nature which carried out nickel plating per solid content 100 section and of the front face to the solution Added the microsphere 20 section, fully agitated, applied the obtained dispersion liquid on the separator by the applicator, it was made to dry for 10 minutes at 85 degrees C, and the film glue with a thickness of 50 micrometers of an ordinary temperature weak adhesive property was obtained.

[0018] The foaming condition with a good place which applied the RF oscillation to the film glue obtained above for 10 seconds with high-frequency-induction-heating equipment (2MHz, 3kw) was formed.

[0019] Dissolved the example 2 rubber modified epoxy resin 100 section, the dicyandiamide 8 section, the gamma-aminopropyl triethoxysilane 1 section, and the stainless steel powder 50 section in toluene, and prepared the adhesives solution of 25 % of the weight of solid content concentration, and added the microcapsule 1 following section to the solution per solid content 100 section, fully agitated, applied the obtained dispersion liquid on the separator by the applicator, it was made to dry for 10 minutes at 85 degrees C, and film glue with a thickness of 50 micrometers was obtained. The aforementioned microcapsule is formed by the coacervation method using polysulfone (wallplate), 3-(3, 4-dichlorophenyl)-1, and 1-dimethyl urea and an AZOJI carvone amide system foaming agent.

[0020] The adhesives solution which made the 80 sections the loadings of example 3 stainless-steel powder was used, and also film glue was obtained according to the example 2.

[0021] Time amount until it carries out high-frequency induction heating of the film glue obtained in the aforementioned examples 2 and 3 and hardens it was investigated. Moreover, after saving film glue for three weeks at 40 degrees C, the setting time was investigated like the above and preservation stability was evaluated.

[0022] The result was shown in Table 1.

[Table 1]

	実施例 2	実施例 3
硬化時間	4分 2 7 秒	4分 2 5 秒
保存安定性	変化なし	変化なし

[0023]

[Effect of the Invention] Since a microcapsule is destroyed by the high-frequency induction heating through a ferromagnetic according to this invention, capsule destructive power can be given to a capsule content material directly and alternatively, there is little effect of the heat to other material systems etc.,

and it can apply to broad objects, such as a large-sized object and a low heatproof object, without requiring thermal resistance of the whole system. Moreover, destructive processing can be carried out in a short time, without excelling in the responsibility of generation of heat, or the uniformity of generation of heat in the whole, and damaging a front face.

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**TECHNICAL FIELD**

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[Industrial Application] This invention relates to the approach of destroying efficiently the microcapsule made to contain in a material by induction heating by the RF.

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PRIOR ART

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[Description of the Prior Art] Like the hardening mold adhesives which encapsulated a part of system of reaction, or a color coupler, the various materials which are made to contain a microcapsule as a control system and attained the control purpose under the destruction are proposed. For example, with the aforementioned hardening mold adhesives, encapsulating and blending a curing agent and raising the storage stability of adhesives, a capsule is destroyed at the time of the need, and a curing agent is opened wide and it is prepared as what could be made to carry out hardening processing (JP,48-76935,A).

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[0004] However, it was required that the load of heat, the pressure, etc. should have been carried out also to material systems other than a capsule content material, and the load should have been borne by any approach at the whole system, and there was a trouble that the candidate for application was restrained greatly. Incidentally in the case of said adhesives, it is difficult to apply to adherend lacking in pressure resistance by the heating approach from the exterior in large-sized adherends, such as a construction material, and the approach of it being difficult to apply to the adherend of low thermal resistance which is easy to produce heat deformation and melting like plastics, and destroying by a pressure etc.

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**EFFECT OF THE INVENTION**

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**TECHNICAL PROBLEM**

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[Problem(s) to be Solved by the Invention] This invention makes a technical problem development of the destructive approach of the microcapsule which can be applied to a broad object without are, carry out, being able to carry out the load of the destructive power alternatively, and there are few direct loads to other material systems, such as adherend, and requiring resistance of the whole system from the material of microcapsule content.

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MEANS

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[Means for Solving the Problem] This invention offers the destructive approach of the microcapsule characterized by making a ferromagnetic contain, carrying out induction heating by the RF, and making a microcapsule destroy in the material which made the microcapsule contain.

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OPERATION

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[Function] By the above-mentioned configuration which carries out induction heating by the RF, the material containing a ferromagnetic can be heated directly and alternatively, and the microcapsule of content can be destroyed through the generation of heat. Therefore, there are few loads to material systems other than the material containing a ferromagnetic and a microcapsule, and it can apply to broad objects, such as a large-sized object and a low heatproof object, without requiring thermal resistance of the whole system.

[0008]

[Description of Component Elements of the Invention] This invention makes a ferromagnetic contain with a microcapsule in a material, and destroys a microcapsule by induction heating by the RF. There is especially no limitation about the material which makes a microcapsule and a ferromagnetic contain. As the example, a ceramic system material metallurgy group system material like a material, other paper system materials, etc. for forming a polymer system material, and porosity glass and metallic foil like adhesives or a foam formation material can be raised. In addition, practical use may be presented with this material as mold goods to arbitrary gestalten, such as fiber, and cloth, a sheet.

[0009] Combination of the ferromagnetic to the inside of a material can perform a microcapsule by the method with the proper method blended as what was separated like the method blended as a microcapsule covered with the ferromagnetic like the method which blends the mere mixture of the method and ferromagnetic which are blended with a microcapsule in one, and a microcapsule. In this invention, the ferromagnetic should just contain in the material. In addition, the microcapsule covered with the ferromagnetic can be formed by the method with proper dryblend methods, such as for example, a plating method, powder, and fiber, etc.

[0010] A proper thing may be used for a ferromagnetic. Generally, the alloy which makes a principal component simple substances, such as iron, nickel, chromium, copper, aluminum, titanium, zinc, and tin, and it thru/or a constituent, the stainless steel like SUS340, the alloy like a permalloy, the metallic oxide like a ferrite, Fe-nickel-P, the amorphous alloy like Fe-Co, etc. are used. A ferromagnetic can be used with proper gestalten, such as powder, and a staple fiber, a plating object to plastics fine particles.

[0011] About the microcapsule which a material is made to contain, it is arbitrary, and is suitably chosen according to the purpose of using a material. Therefore, proper things, such as chemical reaction system matter like a curing agent and physical-change matter like a foaming agent, can be used arbitrarily [ the class of karyomitome included in a capsule ]. From points, such as equal dispersibility, 100 micrometers or less, above all, although the particle size of a microcapsule has an about 1-30-micrometer desirable thing, it is not limited to this. In addition, capsulation of karyomitome can be performed by for example, the coacervation method, interfacial polymerization, etc.

[0012] Like polyvinyl alcohol, a polyvinyl butyral, polymethylmethacrylate, a polyacrylonitrile, a polyvinylidene chloride, and polysulfone, the wallplate of the microcapsule in this invention may consist of heating melting nature matter, and may be destroyed by thermal expansion. In the case of the thermal-expansion nature particle which used the gasification matter especially for karyomitome, it may be formed with arbitrary wallplates.

[0013] The proper method according to physical properties, such as the melting point of a material, the heat-resistant temperature of a microcapsule, etc. can perform preparation of the material containing a ferromagnetic and a microcapsule. The method which mixes a material, a ferromagnetic, a microcapsule, or the microcapsule covered with the ferromagnetic is held using the method and 2 mills which mix the solution of a material, a ferromagnetic, a microcapsule, or the microcapsule covered with the ferromagnetic as the example, 3 mills, a paint roll, a roll mill, an extruder, a Banbury mixer, a planetary mixer, and the proper kneading machine like a kneader. In addition, in the case of the mixed method by heating melting, the microcapsule destroyed at an elevated temperature rather than the melting point of a material is used.

[0014] The ferromagnetic to the inside of a material and the loadings of a microcapsule are suitably determined according to the purpose of using the heating conditions by the destructive property and RF of a microcapsule, and a material etc. Generally, the ferromagnetic of per [ 1 ] material 100 weight section - 80 weight sections and the microcapsule of 1 - 50 weight section are used.

[0015] Destruction of the microcapsule in a material can be performed by heating it through a ferromagnetic in a RF magnetic field. Therefore, when materials are adhesives, by arranging adhesives for example, between adherends and placing it into a RF magnetic field, adhesion processing can be carried out and application on a large area object is also easy. There is especially no limitation about the high-frequency oscillator to be used, and, generally the thing of 104-106kHz, an output 1 - 200kw extent is used. In addition, the foil of a ferromagnetic etc. may be made to be placed between processing-object systems if needed in this invention for the purpose of improvement in the exoergic effectiveness by the RF, compaction of the processing time, etc.

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EXAMPLE

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## [Example]

Dissolve the example 1 chloroprene-rubber 100 section (it is the same the weight section and the following), the denaturation rosin resin 20 section, and the terpene phenol resin 15 section in toluene, and the adhesives solution of 30 % of the weight of solid content concentration is prepared. the microcapsule (the Matsumoto fats-and-oils company make --) of the thermal-expansion nature which carried out nickel plating per solid content 100 section and of the front face to the solution Added the microsphere 20 section, fully agitated, applied the obtained dispersion liquid on the separator by the applicator, it was made to dry for 10 minutes at 85 degrees C, and the film glue with a thickness of 50 micrometers of an ordinary temperature weak adhesive property was obtained.

[0018] The foaming condition with a good place which applied the RF oscillation to the film glue obtained above for 10 seconds with high-frequency-induction-heating equipment (2MHz, 3kw) was formed.

[0019] Dissolved the example 2 rubber modified epoxy resin 100 section, the dicyandiamide 8 section, the gamma-aminopropyl triethoxysilane 1 section, and the stainless steel powder 50 section in toluene, and prepared the adhesives solution of 25 % of the weight of solid content concentration, and added the microcapsule 1 following section to the solution per solid content 100 section, fully agitated, applied the obtained dispersion liquid on the separator by the applicator, it was made to dry for 10 minutes at 85 degrees C, and film glue with a thickness of 50 micrometers was obtained. The aforementioned microcapsule is formed by the coacervation method using polysulfone (wallplate), 3-(3, 4-dichlorophenyl)-1, and 1-dimethyl urea and an AZOJI carvone amide system foaming agent.

[0020] The adhesives solution which made the 80 sections the loadings of example 3 stainless-steel powder was used, and also film glue was obtained according to the example 2.

[0021] Time amount until it carries out high-frequency induction heating of the film glue obtained in the aforementioned examples 2 and 3 and hardens it was investigated. Moreover, after saving film glue for three weeks at 40 degrees C, the setting time was investigated like the above and preservation stability was evaluated.

[0022] The result was shown in Table 1.

[Table 1]

	実施例 2	実施例 3
硬化時間	4分 27秒	4分 25秒
保存安定性	変化なし	変化なし

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**WRITTEN AMENDMENT**

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[Procedure revision]

[Filing Date] June 16, Heisei 5

[Procedure amendment 1]

[Document to be Amended] Specification

[Item(s) to be Amended] 0010

[Method of Amendment] Modification

[Proposed Amendment]

[0010] A proper thing may be used for a ferromagnetic. Generally, the alloy which makes a principal component simple substances, such as iron, nickel, chromium, copper, aluminum, titanium, zinc, and tin, and it thru/or a constituent, the stainless steel like SUS430, the alloy like a permalloy, the metallic oxide like a ferrite, Fe-nickel-P, the amorphous alloy like Fe-Co, etc. are used. A ferromagnetic can be used with proper gestalten, such as powder, and a staple fiber, a plating object to plastics fine particles.

[Procedure amendment 2]

[Document to be Amended] Specification

[Item(s) to be Amended] 0015

[Method of Amendment] Modification

[Proposed Amendment]

[0015] Destruction of the microcapsule in a material can be performed by heating it through a ferromagnetic in a RF magnetic field. Therefore, when materials are adhesives, by arranging adhesives for example, between adherends and placing it into a RF magnetic field, adhesion processing can be carried out and application on a large area object is also easy. There is especially no limitation about the high-frequency oscillator to be used, and, generally the thing of 102-106kHz, an output 1 - 200kw extent is used. In addition, the foil of a ferromagnetic etc. may be made to be placed between processing-object systems if needed in this invention for the purpose of improvement in the exoergic effectiveness by the RF, compaction of the processing time, etc.

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